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KRA 787
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United States Department of Agriculture
Agricultural Research Service

Food & Nutrition Research Briefs

Protein Saves Bone in Elders

It's no secret that people need ample calcium and vitamin D to maintain strong bones, even in their twilight years. Now, a study suggests that protein may be important in reducing bone loss in elders. The 70- to 90-year-old men and women with the highest protein intakes lost significantly less bone over a four-year period than those who consumed half as much—or less. Animal protein, as well as overall protein intake, was associated with preserving bone.

The findings run counter to studies of younger people that found diets high in protein, especially animal protein, caused the body to excrete more calcium. However, they confirm several large population studies showing protein to have a positive overall effect on bone.

The study was conducted by researchers with the Hebrew Rehabilitation Center for Aged, Research and Training Institute; Boston University; and the Jean Mayer USDA Human Nutrition Research Center on Aging—all in Boston, Mass. Their findings are in the *Journal of Bone and Mineral Research*, 2000 (vol. 15, pp. 2504-2512).

Using data from 615 participants in the Framingham (Mass.) Osteoporosis Study, the researchers examined the relationship between the participants' protein intakes in 1988-89 and changes in their bone mineral density four years later. They accounted for all factors known to increase risk of bone loss, including weight change, calcium and total energy intakes, smoking, alcohol and caffeine intakes, physical activity and, for the women, estrogen use.

Participants who reported the lowest daily protein intakes—roughly equivalent to half a chicken breast—had lost significantly more bone in the hip and spine four years later than those with the highest intakes—equivalent to about 9 oz. of steak and a cup of tuna salad. The group with the next lowest intake—equivalent to about two cups of cottage cheese daily—also lost more bone than the highest-intake group, though the loss was significant only at the hip.

People can search the USDA food composition tables for the protein content of more than 6,000 foods at: http://www.nal.usda.gov/fnic/cgi-bin/nut_search.pl

For more information, contact Katherine L. Tucker, (617) 556-3351, Jean Mayer USDA Human Nutrition Research Center on Aging, Boston, MA; tucker@hnrc.tufts.edu

With Burgers—Don't Let Appearances Fool You

Planning a cookout? To be on the safe side, you'd be wise to check the internal temperature of those ground beef burgers with a meat thermometer instead of relying on color. ARS researchers found that the way in which the meat is handled before cooking can make it look like it's been adequately cooked—to a temperature of at least 160 degrees F—when it really hasn't.

The researchers cooked ground beef patties on a gas grill and used a thermometer to determine when the burgers reached 135, 151 and 160 degrees F—the temperature at which *Eschericia coli* is killed. They also cooked burgers until the meat color turned brown without using a thermometer. Purchased at the local supermarket, some of the ground beef was shaped into patties and cooked immediately; some was shaped into patties and frozen; and some was frozen in its bulk form.

They found that a burger with a brown center is not necessarily safe to eat. Premature browning was not evident in frozen patties that were thawed and then cooked. But beef that was frozen in bulk, thawed, formed into patties, and immediately cooked appeared brown in the center at unsafe temperatures. Also, burgers removed from the grill with pink centers continued to brown for several minutes. Patties cooked to 135 degrees F and allowed to sit for about four minutes looked the same as those cooked to 160 degrees F.

The research, published in the *Journal of Muscle Foods*, 2000 (vol.11, pages 213-226), reinforces the current advice to use a meat thermometer when cooking burgers.

USDA's Food Safety and Inspection Service uses these findings to suggest guidelines for safe food temperatures.

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Peppers Put the "Heat" on Candida, Plus

Cayenne pepper—a popular spice for flavoring food—is known for its heat-producing properties due to the substance capsaicin. ARS scientists have found that the peppers contain another potent substance in the saponin chemical family that kills several noxious fungi and yeasts, including *Candida albicans*. And because this pepper saponin—called CAY-1—is not toxic to human cells at microbe-killing doses, a Denver, Colo., firm has begun testing its potential as a candidate drug for treating patients with fungal infections. MycoLogics, Inc., has a cooperative agreement with ARS, which has filed for a patent on the compound.

The ARS researchers discovered CAY-1 while looking for plant compounds that could be used as crop protectants against spoilage microorganisms such as *Aspergillus* fungi, which produce aflatoxins. Cayenne peppers topped an unusual list of organisms—including Cecropia moths, tree frogs and bacteria—that produce other novel antifungal compounds.

The researchers speculated that CAY-1's properties might also interest medical researchers seeking candidate compounds to fight emerging fungal threats to human health. That curiosity led to collaborative studies with researchers at the National Institutes of Health, the University of Cincinnati and MycoLogics, Inc.

Different CAY-1 concentrations were tested against germinating and non-germinating cultures of four bacterial, six fungal and one yeast species. In one test against *C. albicans*, which causes thrush in babies and vaginal infections in women, a solution of 2.6 parts per million curbed the microbe's growth by 93 percent. And none of the CAY-1 concentrations tested caused harm to human cervix cell cultures. CAY-1 also wasn't toxic to cells from lung tissue, where *Aspergillus* and *Pneumocystis carinii* fungi can cause serious infections in immuno-compromised patients.

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Reducing Two Human Pathogens at the Farm

Now there's a practical approach to reducing two major foodborne pathogens in pigs and cows. ARS researchers found that sodium chlorate—oxidized table salt—fed in low doses before slaughter, selectively kills the pathogens *Salmonella typhimurium* and *E. coli* O157:H7. They fed 45 weaned pigs as much as 0.04 grams of sodium chlorate per kilogram of body weight after being inoculated with *S. typhimurium*. Within 16 hours, the number of pathogenic cells in the intestines dropped from 1,000 per milliliter to less than 10.

The treatment is effective because *Salmonella* and *E. coli* O157:H7 have an enzyme—respiratory nitrate reductase—that beneficial intestinal bacteria lack. This enzyme converts the sodium chlorate to chlorite, which kills the harmful bacteria. The beneficial bacteria lack the enzyme, so they are unharmed by the added chlorate.

Gut and lymph tissue in meat animals are major reservoirs for *Salmonella* or *E. coli* O157:H7. The U.S. Centers for Disease Control and Prevention estimate that about 1.4 million cases of human salmonellosis and 73,000 cases of diarrheal illness caused by O157:H7 occur in the United States each year.

USDA applied for a patent on behalf of the ARS inventors, who are seeking a cooperative research partner to further develop the work for commercial meat processing. The researchers suggest an alternative to adding sodium chlorate to the feed: add it to the animals' drinking water upon arrival at the processing facility. However, the U.S. Food and Drug Administration would need to approve any wide-scale use of this technique.

For more information, contact David J. Nisbet, (979) 260-9368, or Robin C. Anderson, (979) 260-9317, Food and Feed Safety Research Unit, College Station, TX; nisbet@ffsru.tamu.edu, anderson@ffsru.tamu.edu

Chance of Colon Cancer Connected to Copper Consumption

Take some oysters, liver, nuts and seeds, wash them down with a little cocoa, and top them off with a chocolate bar for dessert. While this combination may not appeal to your taste buds, including these foods in a well-balanced diet may reduce your risk of colon cancer, according to recent animal studies by ARS scientists. These foods are all high in copper—an essential trace element that is below the new recommended intake (0.9 milligram per day) in about one-quarter of U.S. diets.

New studies of mice and rats add to evidence that a low-copper diet significantly increases risk of colon cancer—the second leading cause of cancer mortality in the United States and the fourth worldwide. Diet is thought to be the single greatest contributor to colon cancer in humans, possibly accounting for 35-45 percent of the disease risk. Now, copper joins selenium, calcium, carotenoids and fiber as being important for a healthy colon.

The researchers will soon report in *Biofactors* that rats raised on only one-fifth of their copper requirement had

significantly more precancerous lesions in their colons than the animals that got adequate copper after both groups were given a cancer-causing chemical. And copper-deficient colon cells showed enzyme abnormalities that have been reported in precancerous lesions in both humans and rats.

The researchers also looked for a copper connection in mice with a genetic predisposition to develop intestinal tumors. Since the mouse mutation is similar to one found in some human families, these animals make a good model for testing the effects of dietary changes. Not surprisingly, the mice fed the copper-deficient diet had significantly more and bigger tumors than the animals fed adequate copper. These findings were reported in *Cancer Letters*, 2000 (vol. 159, pp. 57-62).

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Daughters Mimic Moms' Beverage Choices

Mothers who want their growing daughters to get ample calcium—so necessary for building bones—take heed: Actions really do speak louder than words. A new study found that mothers who routinely drank milk and consumed few soft drinks had daughters who did the same. Likewise, mothers who routinely drank soft drinks and avoided milk had soft-drink-loving daughters who drank little milk. The study involved nearly 200 pairs of 5-year-old European-American girls and their mothers.

Reporting in the *Journal of Nutrition*, 2001 (vol. 131, pp. 246-250), the researchers found that mother-daughter pairs who drank more soft drinks also consumed less calcium. Girls who consumed more than one serving of non-juice or soft drink beverage daily consumed an average 150 milligrams less calcium per day than their soft-drink-limiting peers. Although other foods can provide adequate calcium in the diet, dairy foods remain the primary source for most children.

According to national dietary surveys, while calcium intake among 2- to 5-year-olds is usually adequate, the average 9- to 18-year-old consumes just over half of the 1,300 mg of calcium daily recommended for this age group. One in five consumes a mere 500 mg each day—or less.

The findings suggest that by simply being a good role model and making milk and other low-fat dairy products more available in the home, mothers can increase how much calcium their daughters consume. And this could yield personal benefits. Currently, less than one in 10 women meets the daily calcium recommendation for adults. For those who can't consume milk, other good sources of calcium include calcium-fortified soy beverages, tofu and breakfast cereals; canned fish with soft bones, such as sardines and salmon; and dark-green leafy vegetables.

For more information, contact Jennifer Fisher, (713) 798-7000, Children's Nutrition Research Center at Baylor College of Medicine, Houston, TX; jfisher@bcm.tmc.edu

Choline Status Can Hinge on Folate Intake

Our bodies can't make enough of the B vitamin choline if we are low in it and a second B vitamin—folate. That's according to a study by ARS and university researchers. The findings agree with some animal studies conducted earlier at the ARS center in Boston and by other nutrition researchers elsewhere. In all, these investigations helped pave the way to the current recommended choline intake of 425 milligrams a day for women and 550 mg for men.

The study with male and female volunteers included low-folate, low-choline regimens that provided as little as 13 percent of today's recommended daily allowance of folate. No severe choline or folate deficiencies occurred during the study. But blood levels of choline decreased an average of 25 to 28 percent in men and women during the low-folate, low-choline stints, the researchers reported in the *Journal of Nutrition*, 1999 (vol. 129, pp. 712-717). Those levels returned to at least normal when researchers provided more folate.

Meats, dairy products and soy foods are rich in choline. Folate is highest in orange juice, green leafy vegetables like spinach, and bread flour or other grain products fortified with this vitamin. Nuts and liver contain both nutrients.

Choline helps us absorb and use fats. It is required for making acetylcholine, a neurotransmitter needed for muscle control, memory storage and other functions. Both nutrients contain what's known as a methyl group, which the body uses to form genetic material, or DNA.

For more information, contact Robert A. Jacob through June 6, 2001 at (701) 795-8456, Grand Forks Human Nutrition Research Center, Grand Forks, ND; rjacob@gfhnrc.ars.usda.gov; thereafter, at (530) 752-4726, Western Human Nutrition Research Center, Davis, CA; rjacob@whnrc.usda.gov

New Raspberry Extends Fresh-Market Season

Fresh red raspberries will be available through July thanks to Coho, a new variety released by ARS and the agricultural experiment stations of Oregon, Washington and Idaho. Coho will extend the availability of fresh berries by 7 to 10 days compared to Tulameen, the current late-season standard throughout much of the

world. Raspberries are low in fat and a good source of dietary fiber. Along with blueberries and blackberries, they are also a rich source of anthocyanins, which are potent antioxidants.

Coho gives high yields of bright-red, very firm berries. It should grow well in the Pacific Northwest and California, or in other raspberry-growing areas where winter temperatures don't fall below zero degrees F. The Pacific Northwest—including Oregon, where Coho was most extensively tested—and California produce 95 percent of the nation's fresh red raspberries. Growers can obtain plants through several nurseries in the Northwest, and consumers may be able to find Coho berries this summer.

For more information, contact Chad E. Finn, (541) 750-8759, Northwest Center for Small Fruit Research, Corvallis, OR; finnc@bcc.orst.edu

New Food Uses Unfold for Fantesk

Starch, water and oil can mix to become a material with an unusual variety of forms. Called Fantesk by its ARS developers, the material has led to partnerships with industry to develop a wide array of new products. Under one of the latest agreements with ARS, Azure Waves Seafood, Inc., of Cincinnati, Ohio, is developing seafoods seasoned with herbs and spices in breading made from Fantesk. Other food applications on the horizon include cheeses, soft-serve ice cream, cookies and muffins.

Fantesk is formed first as a gel when starch, such as cornstarch, and an oil, such as soy oil, are processed in pressurized steam. Tiny droplets of oil remain well distributed in the starch without a greasy feel. The tiny oil droplets, 0.1 to 10 microns in diameter, are ideal places to encapsulate certain fat-soluble compounds that contribute flavor to foods.

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The New, Improved and Integrated Food Survey

When the nationwide food survey begins in 2002, interviewers will be armed with new tools to ensure that their data collection accurately reflects what people eat in America. In addition to the traditional measuring cups, spoons and rulers, interviewers will have a new Food Model Booklet full of scientifically designed, life-size pictures. These will help respondents better estimate the size of that slice of pizza, serving of french fries or glass of cola they consumed during the previous 24 hours. It's one result of three years of work by ARS scientists.

To put the servings in perspective, the researchers had a grid, wedges, circles and several amorphous mounds printed on transparent pages that overlie an image of a full-size dinner plate straddled by a full-size knife. The different-sized mounds—for estimating foods ranging from a dollop of whipped cream to a heap of spaghetti—appear to have depth.

The researchers also expanded and improved the method of questioning respondents to help them remember forgotten foods—nonalcoholic and alcoholic beverages, sweets, snacks, breads and other easily overlooked foods. This new Multiple Pass Method has a number of built-in cues to help jog the memory. In two pilot studies, respondents recalled eating more foods than were reported by their counterparts in the last survey. In one study, they reported 300 more calories, on average.

To further ensure accuracy, the survey research group automated the whole interview, computerizing questions, prompts, and details about the food and how it was prepared. The program contains 2,400 questions about foods with 21,000 possible answers.

The USDA nationwide food survey is being integrated with the National Health and Nutrition Examination Survey—better known as NHANES—which is directed by the U.S. Department of Health and Human Services' National Center for Health Statistics in Hyattsville, Md. That means respondents will report their food intakes and also receive a comprehensive physical exam in NHANES' mobile exam centers.

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The ***Research Briefs*** is published quarterly by ARS Information. For further information or addition to the mailing list, contact Judy McBride, nutrition editor, at (301) 504-1628; or write her at 5601 Sunnyside Ave., Rm. 1-2212-b, Beltsville, MD 20705-**5129**; jmcbride@ars.usda.gov